



INTERMOUNTAIN STATION

Central Reference File

No..... Q.73 X 9.237 VR

Reduce the Sprouting of Pruned White Oak Trees with Motor Oil

STEPHEN G. BOYCE

DAVID J. NEEBE

U.S. FOREST SERVICE RESEARCH PAPER CS-3

Department of Agriculture

Central States Forest Experiment Station — Columbus, Ohio

May 1963

CENTRAL FILE COPY

THE AUTHORS



STEPHEN G. BOYCE became a full-time Forest Service researcher in 1957 when he joined the Station staff at Carbondale, Illinois. His previous experience combined teaching and research at Meredith College, North Carolina State College, and Ohio University. Steve studied forestry and plant ecology at North Carolina State, and stayed long enough to earn a doctorate. He is now Project Leader in forest management research at the Station. He has authored or co-authored about 15 technical publications.



DAVID J. NEEBE was a member of the Station's technical staff at Carbondale, Illinois, from 1956 to 1960. His specialty was planting and plantation management. At present he is with the Division of Forest Economics and Marketing Research in Washington, D. C. Dave received his forestry training at the University of Missouri where he earned both a bachelor's and a master's degree. He is a member of Alpha Zeta (Agriculture Honorary Society) and Pi Mu Epsilon (Mathematics Honor Society).

Reduce the Sprouting of Pruned White Oak Trees with Motor Oil

STEPHEN G. BOYCE
DAVID J. NEEBE

New branches frequently form on boles of pruned white oak (*Quercus alba L.*) (4, 7)¹. If persistent, these branches form knots that degrade the logs and reduce the value of the lumber when the trees mature (3). In Europe, low concentrations of esters of 2,4-D and sodium chlorate have been used to kill branches on both oaks and poplars (1,5,6,8). The chemicals are sprayed on the branches to be killed and sometimes on the lower part of the tree boles. But, the dead branches usually remain on the trees several years and some new branches continue to form. A more efficient method is needed.

Five years ago we began looking for a compound that would reduce sprouting on pruned white oak trees. In contrast to the European method, we applied a chemical to kill suppressed buds only after first pruning the branches away from tree boles with a pruning saw. After trying out a number of growth regulators, herbicides, defoliating compounds, oils, and solvents, we found that the most practical material for reducing sprouting was SAE 20W motor oil. The motor oil was not completely effective but, when properly applied, practically all suppressed buds were killed and the trees rarely were injured. New branches on the lower 17 feet of the stem of trees coated with motor oil averaged less than three. We believe SAE 20W motor oil to be cheap and effective in reducing sprouting on pruned white oaks.

¹Numbers in parentheses refer to Literature Cited, p. 9.

Methods

All new sprouts and branches on the lowerbole of oaks develop from suppressed buds (fig. 1). Apparently, compounds that form in the crown and move down the stem suppress these buds. Removal of the crown results in most suppressed buds developing into branches (fig. 2). For this reason, we considered that the best check of a material's effectiveness in killing suppressed buds was to prune trees and remove the crowns before application.

The trees on which materials were evaluated ranged from $3\frac{1}{2}$ to 5 inches in diameter and from 37 to 48 feet in height. Any other trees within 20 feet of these trial trees were cut. Trials were made at four different times: in March and June of 1958, in March of 1959, and in March of 1960. In the first three trials, tops were removed at 20 feet from half the trees studied and each material applied to 17 feet on two trees with tops intact and two with tops removed, each tree chosen at random. Materials were applied to white oaks with paint brushes in the first three trials; they were sprayed on white and black oaks (*Quercus velutina* Lam.) in the fourth. Sets of untreated trees as controls were set aside for the first and fourth trials. The second trial in June 1958 was the only trial during the growing season. In the three March dormant season trials, pruning, topping, and applications were all completed 3 weeks before buds opened.

Figure 1.—The branches on this white oak tree grew from the suppressed buds formed from the terminal shoot in the development of this part of the stem. Branches were 1 to 6 years old; the stem was 24 years old.

Figure 2.—Removal of the crown causes most of the suppressed buds to develop into branches. The white oak on the left was pruned to 20 feet and the remaining crown was removed; 58 new branches formed. The tree on the right was pruned to 20 feet and the crown was left intact; only 12 new branches formed.



Eighteen materials were evaluated in the four trials. For the first trial in March 1958, ten were applied to white oaks (table 1). Two of the materials, maleic hydrazide and a mixture of 2,4-D and 2,4,5-T, were applied in two concentrations.

Later, for the second trial in June 1958, five materials were applied. These included three applied earlier in the first trial, SAE 20W motor oil, No. 2 fuel oil, and paraffin oil, and two applied for the first time, used motor oil and Stoddard solvent. They were applied during the growing season when leaves were fully grown.

TABLE 1.—*Results of “painting” treatments¹*

Material	Average number of live branches per tree (lower 17 feet)			Type of injury
	4 years after Before: pruning and treating:		: removed: not removed :	
pruning: Crowns: Crowns				
Motor oil, SAE 20W ^{2/}	33.8	2.5	2.5	None
2,4-D; 2,4,5-T (500 p.p.m. of each mixed in fuel oil)	18.2	-	-	All trees dead
2,4-D; 2,4,5-T ^{2/} (100 p.p.m. each in fuel oil)	34.0	1.0	2.0	Wood distorted; some cambium killed
Fuel oil, No. 2 ^{2/}	19.5	1.0	1.0	Some cambium killed
Paraffin oil ^{2/} (100 viscosity, emulsifiable, without dilution)	25.0	2.0	3.5	Half of trees dead; some cambium killed on others
Turpentine	27.8	28.0	11.0	One tree dead; some cambium killed on others
3-amino-1,2,4-triazole (1 percent in water)	18.7	54.5	19.0	None
Beta-indoleacetic acid (150 p.p.m. in water)	19.5	87.5	16.0	None
Methyl-ester-naphthaleneacetic acid (150 p.p.m. in water)	32.5	67.0	16.0	Wood distorted
Beta-indolebuteric acid (150 p.p.m. in water)	26.8	110.0	28.0	None
Maleic hydrazide (1,500 p.p.m. in water)	18.8	43.5	15.5	None
Maleic hydrazide (750 p.p.m. in water)	32.2	72.5	11.5	None
No chemical applied	19.9	63.5	10.5	None

^{1/} Counts of live branches were made in March 1958 before pruning and treating (brush application) and in fall 1961 at the end of the fourth growing season.

^{2/} The average number of live branches on trees treated with these materials was significantly less than the number of live branches on trees treated with other materials and trees left untreated. For each material, live branches were counted on two trees with crowns removed and two trees with crowns intact.

For the third trial in March 1959, six materials were applied, three applied earlier, SAE 20W motor oil, No. 2 fuel oil, and used motor oil, and three applied for the first time, SAE 10W motor oil, a phosphate cotton defoliant, and a chlorate cotton defoliant.

For the fourth trial in March 1960, six materials were applied, three applied earlier and three new ones (table 2). Each was applied to four white oaks and, unlike materials in the first three trials, to four black oaks also, with four trees of each oak species left untreated. Again unlike the first three trials, all crowns were left intact. Materials were sprayed instead of being applied with a paint brush. A nozzle was extended 20 feet from a "back-pack" sprayer by passing a $\frac{1}{4}$ -inch copper tube through a hollow aluminum pole. We could spray the lower 17 feet from the ground, but had to spray each stem from three different sides to completely cover the surface.

TABLE 2.—*Results of spraying treatments¹*

Type of oil	Average number of live branches per tree (lower 17 feet)	
	: 2 years after	
	: Before pruning	: pruning and spraying ² /
Motor oil, SAE 20W	24.1	2.0
Fuel oil, No. 2	19.6	1.5
Aromatic oil No. 82020 ³ /	32.0	1.5
Aromatic oil No. 82030 ³ /	29.4	1.5
Aromatic oil No. W-10648 ³ /	26.8	2.5
Stoddard solvent	18.9	1.5
No oil applied	20.0	37.0

¹/ Counts of live branches were made in March 1960, before pruning and spraying and in fall 1961, at the end of the second growing season.

²/ The average number of live branches on the treated trees was significantly less than the average number on the untreated trees. In this trial, four trees were treated with each oil and four trees were left untreated.

³/ The Shell Oil Company supplied these oils; numbers are Shell code numbers.

Motor Oil Was the Best for White Oaks

The material that proved most practical for killing suppressed buds on white oak trees was SAE 20W motor oil (fig. 3). Of all 16 trees coated with this oil, one or more new branches formed on only nine trees and as many as six new branches on only one of the nine. The numbers of live branches given in tables 1 and 2 are averages for only four trees in each case, but they also indicate the effectiveness of SAE 20W motor oil. The average number of live branches per tree was less than three even after 4 years. Dissections of stems showed that the suppressed buds from which these new branches developed may have been covered by thick layers of bark or been missed when the oil was applied. Motor oil applied in June during the growing season injured the cambium of trees; however, when applied in March during the dormant season it injured only a small area of the cambium of a single tree. Because 20W motor oil killed most suppressed buds, rarely injured trees when applied during the dormant season, and is both cheap and readily available, it was considered the most practical material.

No. 2 fuel oil, paraffin oil, used motor oil, SAE 10W motor oil, Stoddard solvent, and three aromatic oils also killed suppressed buds, but they injured the trees. More than one-third of the trees coated with these materials had open lesions on the stem within 2 years after treatment (fig. 4). Lesions apparently resulted because these oils penetrated the bark and killed part of the cambium. The 20W motor oil probably caused fewer injuries because of its higher viscosity.

A mixture of 2,4-D and 2,4,5-T at 100 p.p.m. killed the suppressed buds but distorted the wood of the outermost annual ring of the tree and killed some areas of the cambium. At concentrations of 500 p.p.m. this material killed the trees. The two chemicals in the mixture were not used after the first trial.

Other compounds including the cotton defoliants did not kill the suppressed buds (table 1). Three-amino-1,2,4-triazole, beta-indoleacetic acid, methyl-ester-naphthaleneacetic acid, beta-indolebuteric acid, and maleic hydrazide delayed the development of sprouts until the latter part of July of the first growing season. However, 4 years later there were as many or more live branches on the boles as before the trees were pruned (fig. 5).

Whether oils were applied with a paint brush or sprayed apparently made no difference in their effectiveness. But it was more convenient to use a light aluminum ladder and a paint brush than a "back-pack" sprayer with the spray nozzle extended 20 feet. The extended spray nozzle was difficult to move through the woods and



Figure 3 (Left).—SAE 20W motor oil was the most practical material for coating white oaks. This tree was pruned to 20 feet and the crown removed. The stem was then coated to 17 feet with 20W motor oil, as indicated by the aluminum pole. Four years later, only three new branches had formed on the treated section of the stem.



Figure 4 (Right).—Some materials caused lesions on the stem. Stoddard solvent, applied to the stem of this tree 3 years before the picture was made, killed the suppressed buds but also injured the cambium.



Figure 5 (Left).—Some compounds did not kill suppressed buds. Four years after treatment with methyl-ester-naphthaleneacetic acid this pruned and topped white oak had more branches than before treatment.

each tree had to be sprayed from three different sides. It was also more difficult to obtain a uniform application with the sprayer than with a paint brush.

Trees were injured or killed by oils applied during the growing season. Paraffin oil, fuel oil, used motor oil, and Stoddard solvent killed all trees to which they were applied during the growing season within 2 months after treatment. SAE 20W motor oil applied in June killed only one tree but injured large areas of the cambium. Observations indicate the motor oil should be applied at least 3 weeks before buds begin to open in the spring.

Fourteen of the twenty-eight black oaks sprayed with oils in the fourth trial were dead at the end of the second growing season and most of the other trees were injured. Although only one of the trees that was coated with 20W motor oil died, small areas of cambium were injured on the others. For this reason, we do not recommend the use of any of the oils on black oak trees.

Application to White Oak Trees

Coating the stem of pruned white oak saplings with 20W motor oil does not eliminate sprouting completely and there is a chance that the cambium will be injured on some trees. Nevertheless, we believe that owners of young white oak stands can use 20W motor oil to reduce sprouting and increase the value of their trees.

Owners of forest land who wish to use this oil treatment should first select young white oak trees with the best potential. These trees should be from 3 to 5 inches in diameter and at least 30 feet tall so they can be pruned to 17 feet without greatly reducing the crown. Although larger trees can be pruned, the greatest yield of knot-free wood is obtained by treating trees smaller than 5 inches in diameter. The trees selected should be released from competing trees for a distance of at least 20 feet. This facilitates the placing of a ladder against them, and may stimulate their growth.

These trees should be pruned to a height of 17 feet. Since suppressed buds in clusters frequently occur around the base of branches (fig. 6), care should be taken to prune close to the bole and any bud clusters that are apparent should be removed with the pruning saw.

After pruning, but at least 3 weeks before the buds open in the spring, the lower 17 feet of the stem should be uniformly coated with a thin layer of 20W motor oil. The oil can be applied with a paint brush, but should not be applied closer than 1 foot to the ground because the oil is toxic to the roots. Do not apply used motor oil or oil with viscosity lower than that of SAE 20W. A few trees may be



Figure 6.—Suppressed buds frequently occur in clusters around the bases of branches. Bud clusters at the tip of the pencil should be removed at the time that dead stubs of branches are pruned flush with the stem.

injured if the bark is thin or if the oil is applied in a thick layer. However, we believe the overall gains in log quality and in lumber value outweigh the loss of a few treated trees.

If the use of 20W motor oil reduces the average number of new branches to less than three on treated saplings, it is reasonable to assume that the average number of defects will be very small when the butt logs attain a top diameter of 13 inches.² We cannot predict the number of defects when the butt logs mature; but if there are fewer than four defects, more than 80 percent of the logs can be expected to qualify as grade 1 logs. But if there are as many as eight defects, treatment will result in practically no gain in quality or in monetary value (2).

Summary

SAE 20W motor oil was found to be more practical than either other oils or a number of chemicals for killing suppressed buds and thus reducing sprouting on pruned white oak saplings. Coating the stems of the pruned trees with motor oil did not completely eliminate sprouting but did reduce the number of new branches on the lower 17 feet of the stem to an average of less than three. A thin layer of 20W oil applied during the dormant season rarely caused injuries but applications during the growing season injured or killed the trees. Oils of lower viscosity were harmful at any season. Black oaks were injured by all of the oils, even when they were applied during the dormant season. A number of other materials including growth regulators, herbicides, defoliating compounds, low-viscosity oils, and solvents, were not considered practical because they did not kill suppressed buds, injured the cambium, or killed the trees.

²Minimum top diameter for factory grade 1 logs.

Literature Cited

- (1) Bavngaard, A.
1941. VANRIS PAA EG [EPICORMIC BRANCHES ON OAK].
Dansk Skovfor. Tidsskr. 26(28): 389-399, illus. [Reviewed
in Biol. Abs. 23: 8759. 1949.]
- (2) Boyce, S. G., and Schroeder, J. G.
1962. ASSESSING THE VALUE OF DEFECT REDUCTION IN
HARDWOOD LOGS. (In preparation for publication by For-
est Sci.)
- (3) Bryan, W. C.
1960. LOSSES FROM DEFECT IN PIEDMONT HARDWOODS. U.S.
Forest Serv. Southeast. Forest Expt. Sta. Paper 109, 31 pp.,
illus.
- (4) Burns, P. Y., and Nichols, J. M.
1952. OAK PRUNING IN THE MISSOURI OZARKS. Mo. Agr.
Expt. Sta. Bul. 581, 8 pp., illus.
- (5) Leise, W.
1957. ORIENTIERENDE UNTERSUCHUNGEN ZUR CHEMISCHEN
ASTUNG VON PAPELN [Preliminary test of chemical prun-
ing of poplars]. Forst.-und Holzw. 12(17): 297-298. [Re-
viewed in Forestry Abs. 19: 432. 1958.]
- (6) Mayer-wegelin, H.
1959. DIE NEUERE ENTWICKLUNG DER TECHNIK DES AUF-
ASTENS [Development of a new technique for pruning].
Allg. Forstzeitschr. 14(22): 397-400, illus.
- (7) Roth, E. R.
1948. HEALING AND DEFECTS FOLLOWING OAK PRUNING.
Jour. Forestry 46(7): 500-504, illus.
- (8) Splettstosser, A.
1957. ASTEN VON EICHEN MIT WUCHSSTOFFEN [Pruning of
oak with growth regulators]. Forst.-und Holzw. 12(8):
127-130, illus.

The Central States Forest Experiment Station is headquartered at Columbus, Ohio and maintains major field offices at:

Ames, Iowa (in cooperation with Iowa State University)

Athens, Ohio (in cooperation with Ohio University)

Bedford, Indiana

Berea, Kentucky (in cooperation with Berea College)

Carbondale, Illinois (in cooperation with Southern Illinois University)

Columbia, Missouri (in cooperation with the University of Missouri)